SNIA CSTI | CLOUD STORAGE TECHNOLOGIES

Kubernetes in the Cloud – Part One

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SNIA-At-A-Glance

185
industry leading organizations

2,000
active contributing members

50,000
IT end users & storage pros worldwide

SNIA CSTI | CLOUD STORAGE TECHNOLOGIES

What We Do

Educate vendors and users on cloud storage, data services and orchestration

Support & promote business models and architectures: OpenStack, Software Defined Storage, Kubernetes, Object Storage

Understand Hyperscaler requirements Incorporate them into standards and programs

Collaborate with other industry associations

Kubernetes in the Cloud

Contents

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- Containers
- Container Orchestrators
- Kubernetes - What? Why? How?
- Quick demo
- Q&A

Container - What's in a Name?

- Coming from the shipping industry
- Caused aquatic theme for domain

Shipping Containers

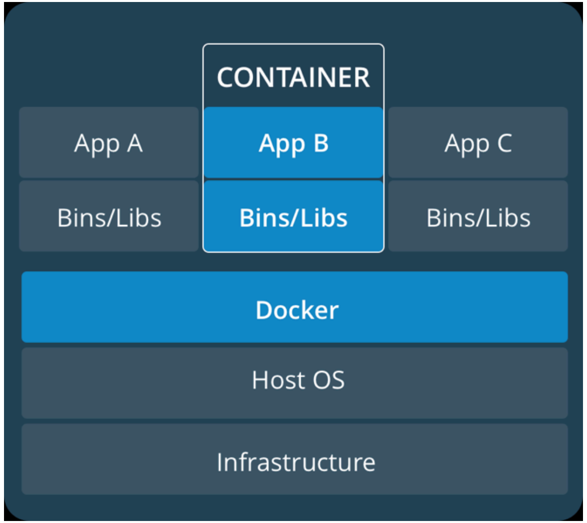
- Portability - can be used on any of supported types of ships
- Wide variety of cargo that can be packed inside
- Standard sizes - standard fittings on ships
- Many containers on a ship
- Isolates cargo from each other

Translated to Software

- Portability - can be used on any supported system (system with container execution environment)
- Wide variety of software that can be packed inside
- Standard format
- Many containers to a physical node
- Isolates execution of one container from another

What is a Container?

- Way to pack code and dependencies together
- Can run anywhere
- Execute multiple containers to a physical machine



Sounds Familiar?

- Same concept as virtual machines
- Pack OS and software together, to run in isolated instances
- Can run anywhere the specific hypervisor runs
- Multiple VMs to a physical machine

How do VMs Work?

- Hypervisor = layer between VM and kernel
- Emulates system calls
- Allows multiple types of operating systems on a machine (Windows on Linux)
- Overhead for hypervisor

Containers on the Other Hand ...

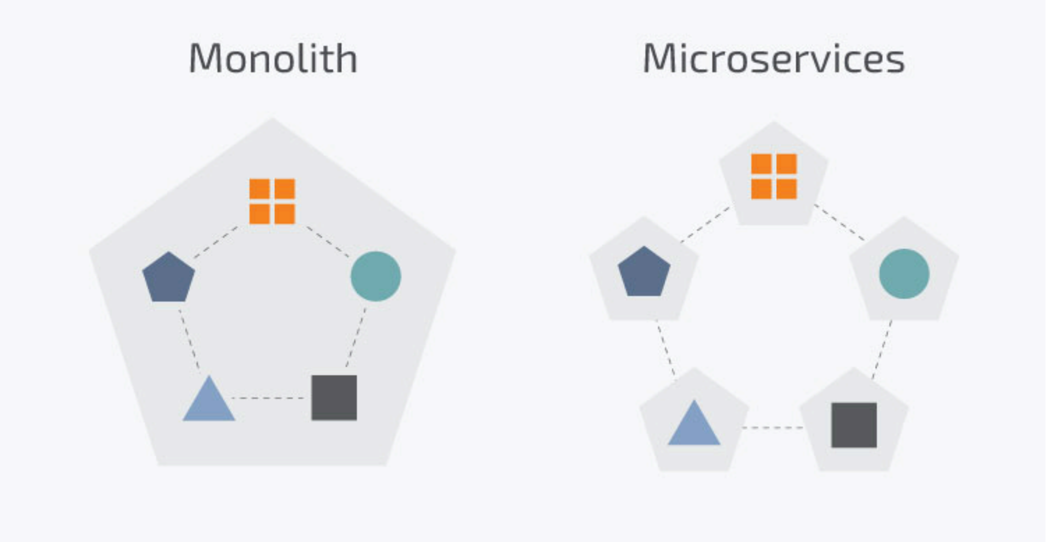
- Only contain application and application-related libraries and frameworks, that run on the host machine's kernel
- Smaller
- Lower overhead
- Differences in OS distributions and dependencies are abstracted - same kernel

Working Together, not against Each Other

- Windows on Linux possible only with VMs
- Older software needs to be adapted to be run as containers (and won’t)
- Usage of VMs as a medium for containers (better isolation and easier scaling)

Greater Modularity in Software

- Monolithic application → independent services that interact (microservices)



Containers Empowering Microservices

- Quicker start times -> easy to prototype or scale
- Allow work to be done independently on modules -> independent releases for components (take care of interfaces)
- Isolated and abstracted runtime environments, that can be tailored for each module
- Shared runtime environment, for heterogenous applications

Containers History – Early Days

- Need for resources to be shared among many users -> multiple terminals connected to the same mainframe
- Main problem - execution can cause the main computer to crash -> down for everybody

Containers History – Isolating More and More

- Chroot – 1979 – change root directory for a running process, along with children → segregate and isolate processes, protecting global environment
- Jails – additional process sandboxing features for isolating filesystems, users, networks (limiting apps in their functionality)
- Solaris Zones – full application environments, with full user, process and filesystem space
- Cgroups – 2006 – process containers designed for isolating and limiting the resource usage of a process

Containers History – Linux Containers (lxc)

2008

- Provides virtualization at OS level
- Provides containers with its own process and network space

Containers History – Docker

2013

- Container execution and management system
  - Originally started with lxc, then moved to libcontainer, which allows containers to work with:
  - linux namespaces
  - libcontainer control groups
  - capabilities
  - app armor security profiles
  - network interfaces
  - firewall rules

Containers History – OCI & CNCF

- Open Container Initiative – 2015
  - Industry format for a container format and container runtime software for all platforms
  - Spend resources on developing additional software to support use of standard containers, instead of format alternatives
- Cloud Native Computing Foundation (CNCF) – 2015
  - Working on different projects to further standardize the Cloud Native open-source market:
    - Kubernetes, Etcd, Prometheus, Envoy, Harbor, and more
    - CSI, CNI, Containerd, and more

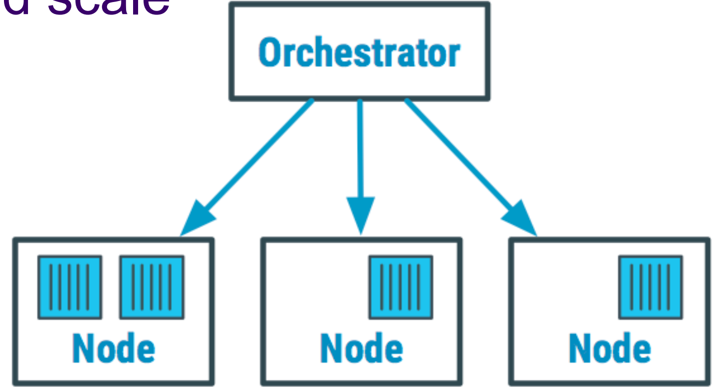
Need for Something More?

- Docker started out as a CLI on top of lxc, that built, created, started, stopped and exec'd containers
- Does management at a node level, upon specific requests
- Easy to manually manage with up to 100s of containers and 10s of nodes, but what next?

Container Orchestration

Orchestrator

- Manage and organize both hosts and docker containers running on a cluster
- Main issue - resource allocation - where can a container be scheduled, to fulfill its requirements (CPU/RAM/disk) + how to keep track of nodes and scale



Some Orchestrator Tasks

- Manage networking and access
- Track state of containers
- Scale services
- Do load balancing
- Relocation in case of unresponsive host
- Service discovery
- Attribute storage to containers
- ...

Kubernetes

What is Kubernetes?

- “Kubernetes” = Greek for governor, helmsman, captain
- Open-source container orchestration system
- Originally designed by Google, donated to and maintained by CNCF
- Aim to provide "platform for automating deployment, scaling and operations of application containers across clusters of hosts"

kubernetes

Why Kubernetes? - Goals

- Main objectives, stated by devs, for community
- Achieve velocity
- Allow scaling of both software and teams
- Present abstract infrastructure
- Gain efficiency

Achieve velocity

- Velocity = number of things you ship while maintaining a highly available service
- Achieved by:
  - Immutability - created artifact cannot be changed
  - Declarative configuration - declare desired state and Kubernetes' job is to ensure it matches
  - Self-healing systems - trying to maintain desired states if something changes

Allow scaling of software

- Encouraging decoupling in applications - separated components that communicate via defined APIs via load-balanced services
- Running in shared abstract environment, without interference
- Utilizing standard container format that runs on any machine

Allow Scaling of Teams

- Separation of concerns for consistency and scaling
- Application ops rely on the SLA provided by the platform
- Orchestrator ops uphold SLA

Present Abstract Infrastructure

- Decoupling container images and machines
- Cluster can be heterogenous and reduce overhead and cost
- Portability - container can be used on another cluster without being changed

Gain Efficiency

- Optimized usage of physical machines - multiple containers on same machine
- Isolated with namespaces, to not interfere with each other

Why Cloud?

- Use Kubernetes offered as managed service
- On demand use, due to quickness of setup of cluster + applications
- Automation, APIs, ...

DEMO

Questions

Join us Next Time…

Computing

Communication

Coordination

Application versioning

Stateful

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Thank You